

Statement of Work
For
Liquid Nitrogen Storage and Delivery System
October 2009

1. Background

- 1.1. The Flight Loads Laboratory (FLL) located at the NASA Dryden Flight Research Center in Edwards, CA routinely performs thermal tests that require the use of both liquid and gaseous nitrogen to facilitate cooling of test hardware and purging of test chambers. The FLL currently uses a 4000-gallon liquid nitrogen (LN2) trailer capable of delivering LN2 at pressures up to 55 psi. In the past, the FLL used a LN2 recharger to deliver gaseous nitrogen (GN2) that was capable of delivering temperature controlled GN2 at a volume flow rate of approximately 760 SCFM and a pressure of 100 psi. The LN2 recharger is no longer a system available to the FLL.
- 1.2. The FLL is looking to procure a liquid nitrogen storage and delivery system that combines the capability to deliver both LN2 and GN2. The following statement of work describes the specifications for the system that the government is seeking to purchase.

2. Scope

- 2.1. The vendor shall design and deliver a turn-key liquid nitrogen storage and delivery system with the following specifications:
 - 2.1.1. Fully insulated vertical LN2 storage tank with a minimum capacity of 7,000 gallons and a maximum working pressure of 175 psig. Tank pressure will be adjustable.
 - 2.1.2. Ability to deliver LN2 at 100 psig and at 15 GPM to an existing vacuum jacketed 2" LN2 line.
 - 2.1.3. Ability to deliver high-purity GN2 to an existing 2" plumbing connection at a volume flow rate of 1000 SCFM and at a pressure of 100 psig (+/- 10 psi) and within a temperature range from -60 to 80°F.
 - 2.1.3.1. Volume flow rates, pressures and temperature are required to be adjustable.
 - 2.1.4. Ability to simultaneously deliver LN2 and GN2 as described in items 2.1.2 and 2.1.3.
 - 2.1.5. GN2 delivery pressure will be less than or equal to LN2 delivery pressure during operation.

- 2.1.6. The system shall have all of the required temperature sensors, pressure gages, liquid level gages and pressure relief devices that will allow safe operation of the system for both LN2 and GN2 operations
 - 2.1.7. An emergency shutoff system that will safely shut off LN2 and GN2 delivery in the event of an emergency situation.
 - 2.1.8. CGA fittings (2-1/2" Nitrogen Connection No. NI-25, Fixed End) shall be used for filling the LN2 storage tank and for delivering LN2 or GN2.
 - 2.1.9. Local and remote control operation and monitoring of LN2 and GN2 delivery.
 - 2.1.10. The pressure vessel shall be ASME Section VIII code stamped and registered with the National Board.
 - 2.1.11. The process piping shall meet the requirements of ASME B31.3, Process Piping. Other piping shall meet the requirements of the most applicable ASME B31 series Code.
 - 2.1.12. All system components shall be appropriately marked and labeled.
- 2.2. The system shall be capable of operating in the following environment:
- 2.2.1. High dust environment.
 - 2.2.2. Temperature range from 0 to 120°F.
 - 2.2.3. Maximum sustained wind speeds of 85 mph.
 - 2.2.4. The pad attachment points for the tank and other major equipment tie down points shall be engineered to meet Zone 4 seismic load requirements. The contractor shall have the drawings reviewed and stamped by a California Licensed Professional Engineer to verify the system is adequate for the intended purpose and installation in a Zone 4 seismic area
- 2.3. The vendor shall design and fabricate a concrete pad for supporting all system components. The concrete pad will be fabricated in coordination with the government. The concrete pad shall be surrounded with appropriate safety barriers to protect the LN2 systems from damage caused by moving vehicles.
- 2.4. The vendor shall submit a site specific Accident Prevention Plan to NASA for review and approval prior to the start of construction. The Accident Prevention Plan shall be prepared in accordance with the requirements set forth in the Section 01 35 14.11 40 of the Dryden Safety Requirements (July, 2007)
- 2.5. The vendor shall be responsible for certifying the liquid nitrogen storage and delivery system for LN2 and GN2 operations.

3. Deliverables

3.1. The vendor shall deliver the following:

- 3.1.1. One liquid nitrogen storage and delivery system designed and built to the specifications stated in Section 2.
- 3.1.2. Preliminary design and critical design packages to the government for review prior to the next phase of design or construction.
- 3.1.3. Engineering Drawings: Within 30 days after contract award, the contractor shall provide N2 system engineering drawings showing the system and the required site requirements.
- 3.1.4. Final design drawings which detail all system components.
- 3.1.5. Manufacturer's documentation on all system components.
- 3.1.6. Certification documents on applicable system components
- 3.1.7. Operating procedures which describe step by step instructions for safely operating the system in both LN2 and GN2 delivery configurations.
- 3.1.8. Requirement and procedures for preventative maintenance, calibration and inspections and replacement.
- 3.1.9. Provide 3 paper copies and 3 electronic copies (CD or DVD) of all as-built drawings, certifications, final procedures, and other final documentation specified above.
- 3.1.10. On-site hands-on training for up to 10 people.